March 30, 2016

Mr. Keith Boyd, P.E.
Land Development PM
Anderson & Associates
100 Ardmore Street
Blacksburg, Virginia 24060

ECS Project No. 01:25638

Reference: Subsurface Exploration and Geotechnical Engineering Services, Clarke County Little League Field Lighting, Berryville, Clarke County, Virginia

Dear Mr. Boyd:

ECS Mid-Atlantic, LLC (ECS) has competed the Subsurface Exploration and Geotechnical Engineering Services for the proposed new lighting for the Clarke County Little League Field in Berryville, Clarke County, Virginia. ECS has prepared this geotechnical engineering letter report to address geotechnical recommendations for the project. The following sections discuss the exploration procedures and present the results of subsurface exploration program.

PROJECT DETAILS

Four 30-inch diameter precast light pole assemblies have been donated for the project. To evaluate the subsurface conditions at the site, 4 soil test borings were advanced at the locations selected by you or others, as depicted on the attached Boring Locations Diagram. The foundations have already been designed for 12 feet of embedment based on a design soil bearing capacity of 1500 psf. The exploration was requested by you to verify that the in-situ subsurface conditions are suitable for the design embedment and bearing capacity specified.

This description of the project is based on information provided to us by your office or other design team members. If any of this information is inaccurate, either due to our misunderstanding or due to design changes that may occur later, we recommend that we be contacted in order to provide additional or alternate recommendations that may be required.

Scope of Work

The conclusions and recommendations contained in this letter report are based on the data derived from the 4 soil test borings. The test boring locations, as depicted on the attached Boring Location Diagram, were established in the field by ECS staff by taping distances, provided by you, from prominent site features indicated on the provided site plan. Please note the boring locations indicated on the attachments are only as accurate as the method used to locate them. Therefore, the boring locations should be considered approximate.

Following field exploration operations, the recovered soil samples were visually classified by an experienced engineering geologist. Soil laboratory tests were not conducted for this evaluation; however, visual soil classifications were determined using procedures outlined in ASTM D2488.

The boring logs from our subsurface exploration are attached to this letter. The Boring Location Diagram depicts the exploration locations with respect to the proposed site conditions. Please note ECS was not provided with topographical information and therefore the ground surface elevations of the borings are based off of information estimated from Google Earth® software.

EXPLORATION PROCEDURES

Subsurface Exploration Procedures

The soil borings were performed with an ATV-mounted auger drill rig, which utilized continuous-flight, hollow-stem augers to advance the boreholes. Drilling fluid was not used in the soil drilling portion of the boring exploration.

In the soil borings, representative soil samples were obtained by means of the split-barrel sampling procedure in general accordance with ASTM Standard D 1586. In this procedure, a 2-inch O.D., split-barrel sampler is driven into the soil a distance of 18 inches or 24 inches by a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler through a 12-inch interval is termed the Standard Penetration Test (SPT) value and is indicated for each sample on the boring logs. This value can be used as a qualitative indication of the in-place relative density of cohesionless soils. It also indicates the consistency of cohesive soils.

Upon completion of soil drilling operations, the borings were backfilled by the spoils generated during the drilling process. A field log of the soils encountered in the borings was maintained by the drill crew. After recovery, each sample was removed from the sampler and visually classified. Representative portions of each sample were then sealed and brought into our laboratory for further review.

EXPLORATION RESULTS

Site Conditions

The site is located on the existing Clarke County Parks and Recreation facility in Berryville, Virginia. The site is currently developed with existing ball fields, a swimming pool, picnic pavillions and general recreation fields. The site is geneerally flat and grass covered with minimal isolated tree areas. Topographical relief across the site is minimal, with site elevations of approximately 645± feet to 650± feet above mean sea level (amsl). Numerous bedrock outrops were observed in the recreational areas and in the immediate area of the test borings.

Regional Geology

The site is located within the Shenandoah Valley in the Valley and Ridge geomorphic province of Virginia. According to the "Geology Map of the Berryville Quadrangle, Virginia" the site and immediate surrounding area is underlain by carbonate lithologies of the Ordovician Age Conococheague Formation, described as a gray to dark gray limestone with interbeds of light to dark-gray dolomite, and with widespread friable sandstone and sandy chert.

Depth to rock can be extremely variable due to the pinnacled nature of weathering that occurs over the parent carbonate (limestone) materials. Ledges or vertical pinnacles of resistant rock can be encountered at or near the surface separated with deep zones of residual soil. Karst conditions are common in carbonate formations. Sinkholes and highly variable top of rock profiles are indicative of karst development.

The limestone bedrock at the site is subject to dissolution and the formation of sinkholes, caves, disappearing streams, and pinnacled bedrock. Such features are indicative of karst development. Karst features were not directly observed at the site; however, incipient karst features may be present below the ground surface or below the depths of our exploration or in locations not explored. Karst features typically encountered below the top of rock may include solution channels and widened fractures, open voids, and mud seams.

Residual soils derived from the chemical weathering of the underlying carbonate bedrock are typically silt and clays with varying amounts of limestone fragments, cobbles and boulders. It should be noted that large detached boulders and cobbles may be present as "float" blocks within the soil mantle overlying the carbonate bedrock. These "float" blocks are potentially large, commonly exceeding three (3) feet in one dimension, and will induce auger refusal with standard geotechnical rotary auger drill rigs. The limestone "float" blocks are soil supported and do not represent the actual bedrock surface when encountered within a geotechnical soil test boring. Therefore, it should be understood that a boring terminated at "auger refusal" does not necessarily indicate the actual top of rock elevation except in locations with either rock coring or supplemental air-track rock probes. As such, the soils underlying limestone "float" blocks have not been tested for in-situ strength.

Subsurface Conditions

The soils identified in the attached boring logs are generally consistent with the regional geology. Topsoil, ranging up to 14± inches, was encountered in the boring locations. Surface gravel was encountered in boring A-1, to a depth of approximately 3± inches. Residual soils, consisting of Lean CLAY (CL) and Fat CLAY (CH), with varying amounts of sand and rock fragments, were encountered overlying the limestone bedrock.

Standard Penetration Test (SPT) N-values within the residual soils ranged from 5 to 17 blows per foot (bpf), indicating medium stiff to very stiff conditions for the cohesive soils encountered. SPT N-values exceeding 50 bpf were encountered on possible bedrock at depths ranging from

4.4± 12.5± feet below existing grades. Auger refusal was encountered at these depths on apparent bedrock in all but one boring, B-1, which was advanced to the planned termination depth of 15 feet below existing grades.

In auger drilling operations, water is not introduced into the boreholes, and groundwater position can often be determined by observing water flowing into the boreholes. Furthermore, visual observation of the soil samples retrieved during drilling operations can often be used in evaluating the groundwater conditions. Groundwater observations were made during drilling operations. Groundwater was not encountered in any of the borings performed to the depths observed.

Groundwater on sites with shallow rock surface is generally partially perched. Specifically, precipitation and/or snow/ice melt that enters the site, either directly or from overland flow, begins to percolate through the low to moderately permeable surficial soils. Once the water percolation reaches the bedrock, which has low secondary permeability, it perches and begins to flow at the interface of the rock and the soil and within the fractures of the bedrock. This groundwater flow continues downhill, with the water table occasionally surfacing to form as wet springs and intermittent streams. The groundwater is related to rainfall, although springs may exist in the lower lying areas for extended periods of time without recharge from precipitation. Therefore, the groundwater conditions at this site are expected to be significantly influenced by surface water runoff and precipitation, especially during high precipitation seasons.

CONCLUSSIONS

The findings of the geotechnical exploration outlined in this letter report are based on the 4 soil test borings, provided site plans and project design specifications. The site generally appears suitable for the planned installation of the precast light poles. The primary factors that could affect the construction are the shallow rock surface, high plasticity soils and potential karst features in the underlying rock mass that may impact the light pole installation and foundation performance.

It is our opinion that the on-site soils and rock are capable of providing the designed bearing capacity of 1,500 psf, provided the competency of the soils and bedrock at and below the tip elevations of the drilled shaft foundations are not compromised due to karst development. Two boring locations B-1 and B-2 were the only test locations to achieve planned tip elevations for the light poles. Test borings A-1 and A-2 will encounter rock conditions above tip elevations; therefore, rock removal boring equipment will likely be required for the light pole installations.

CLOSING

This engineering letter was prepared for the sole use of Anderson and Associates and the project design team and is the only intended beneficiaries of our work. The scope is limited to this specific project and locations described herein and our description of the project represents our understanding of the significant aspects relative to it. In the event of any change in the nature or location of the proposed construction outlined in this report or the accompanying plans and specifications, we should be informed so that the changes can be reviewed and the conclusions of this report modified or approved in writing by the design engineer.

No other party should rely on the information contained herein without prior written consent of ECS Mid-Atlantic, LLC.

We appreciate this opportunity to be of service during the design phase of this project. If you have any questions regarding the information and recommendations contained in the accompanying report, or if we may be of further assistance to you in any way during planning or construction of this project, please contact any of the undersigned.

Respectfully,

ECS MID-ATLANTIC, LLC

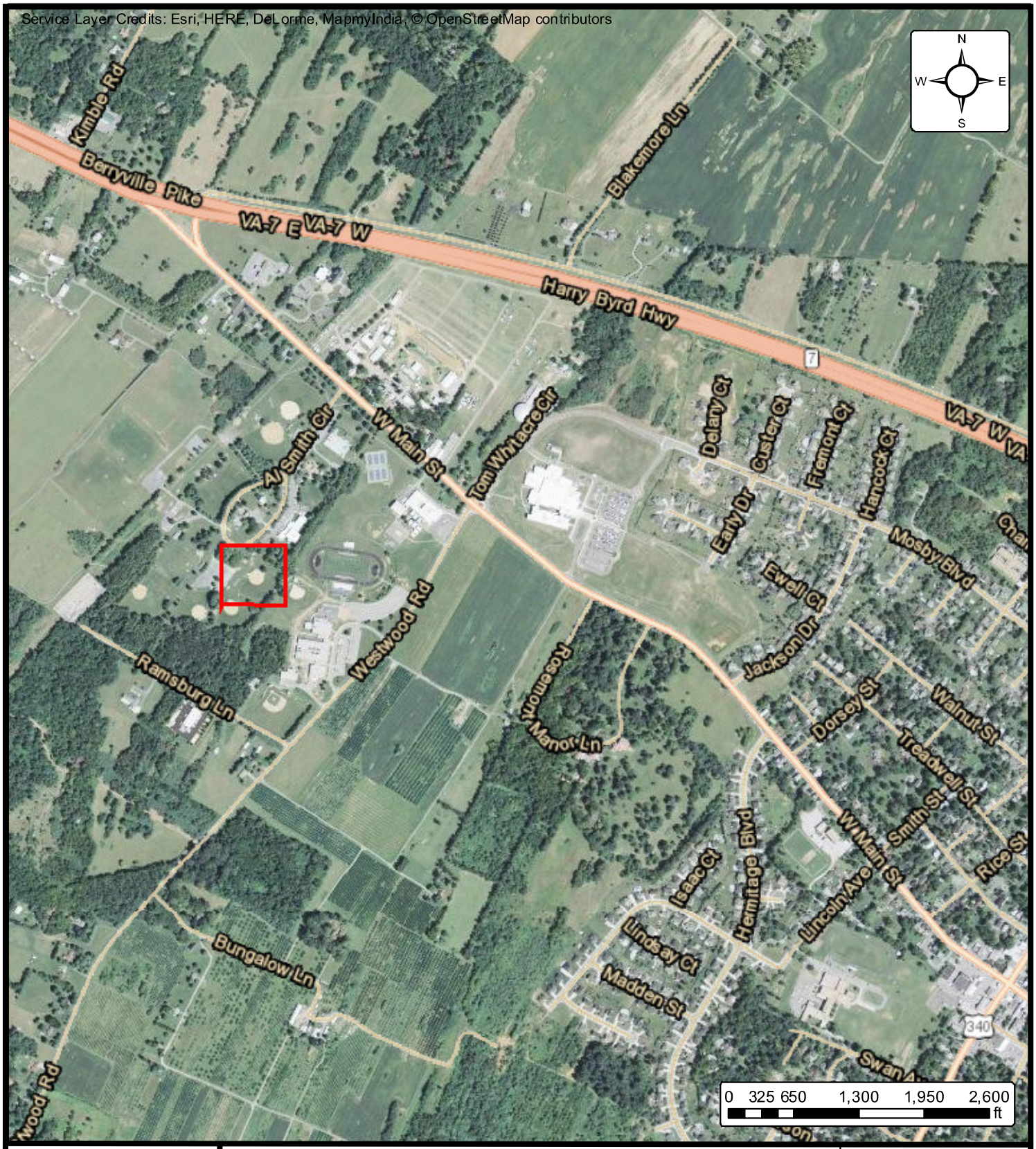
COMMONWEALTH OF VIRGINIA
Stuart B. Mayberry
Lic. No. 36551
03/31/2016
PROFESSIONAL ENGINEER

Joshua W. Holloman, M.Sc., C.P.G.
Senior Project Geologist

Stuart B. Mayberry, P.E.
Senior Project Engineer

R. Drew Thomas, C.P.G.
Principal Engineering Geologist

Attachments: Site Vicinity Diagram
Boring Location Diagram
Boring Logs



Site Location Diagram

CLARKE COUNTY LITTLE LEAGUE FIELD LIGHTING

BERRYVILLE VA 22611

ENGINEER	SBM
SCALE	1 " = 1,326 '
PROJECT NO.	01:25638
SHEET	1 OF 1
DATE	3/30/2016

Boring Location Diagram

CLARKE COUNTY LITTLE LEAGUE FIELD LIGHTING

BERRYVILLE VA 22611

ENGINEER	SBM
SCALE	1 " = 100 '
PROJECT NO.	01:25638
SHEET	1 OF 1
DATE	3/30/2016

REFERENCE NOTES FOR BORING LOGS

I. Drilling Sampling Symbols

SS	Split Spoon Sampler	ST	Shelby Tube Sampler
RC	Rock Core, NX, BX, AX	PM	Pressuremeter
DC	Dutch Cone Penetrometer	RD	Rock Bit Drilling
BS	Bulk Sample of Cuttings	PA	Power Auger (no sample)
HSA	Hollow Stem Auger	WS	Wash sample
REC	Rock Sample Recovery %	RQD	Rock Quality Designation %

II. Correlation of Penetration Resistances to Soil Properties

Standard Penetration (blows/ft) refers to the blows per foot of a 140 lb. hammer falling 30 inches on a 2-inch OD split-spoon sampler, as specified in ASTM D 1586. The blow count is commonly referred to as the N-value.

A. Non-Cohesive Soils (Silt, Sand, Gravel and Combinations)

Density		*Relative Properties*	
Under 4 blows/ft	Very Loose	Adjective Form	12% to 49%
5 to 10 blows/ft	Loose	With	5% to 12%
11 to 30 blows/ft	Medium Dense		
31 to 50 blows/ft	Dense		
Over 51 blows/ft	Very Dense		

Particle Size Identification		
Boulders		8 inches or larger
Cobbles		3 to 8 inches
Gravel	Coarse	1 to 3 inches
	Medium	½ to 1 inch
	Fine	¼ to ½ inch
Sand	Coarse	2.00 mm to ¼ inch (dia. of lead pencil)
	Medium	0.42 to 2.00 mm (dia. of broom straw)
	Fine	0.074 to 0.42 mm (dia. of human hair)
Silt and Clay		0.0 to 0.074 mm (particles cannot be seen)

B. Cohesive Soils (Clay, Silt, and Combinations)

Blows/ft	*Consistency*	*Unconfined Comp. Strength Q_p (tsf)*	*Degree of Plasticity*	*Plasticity Index*
Under 2	Very Soft	Under 0.25	None to slight	0 – 4
3 to 4	Soft	0.25-0.49	Slight	5 – 7
5 to 8	Medium Stiff	0.50-0.99	Medium	8 – 22
9 to 15	Stiff	1.00-1.99	High to Very High	Over 22
16 to 30	Very Stiff	2.00-3.00		
31 to 50	Hard	4.00–8.00		
Over 51	Very Hard	Over 8.00		

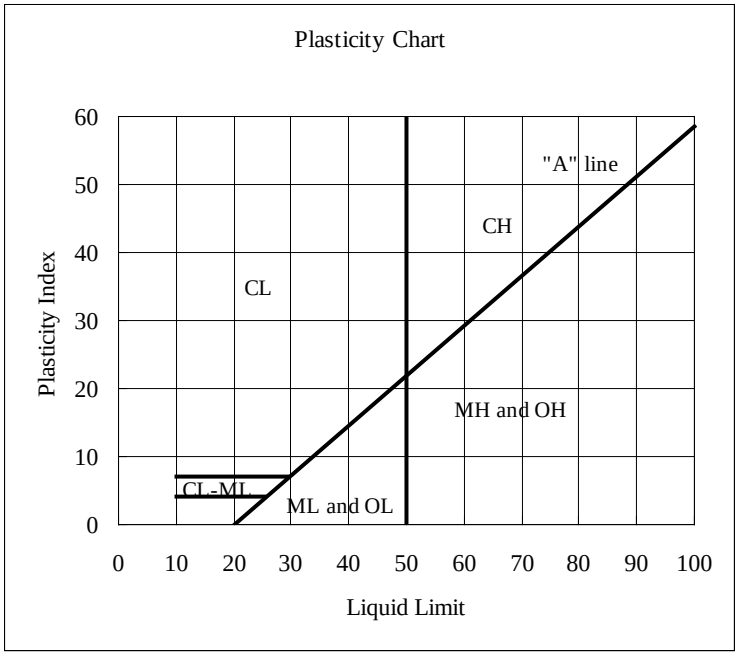
III. Water Level Measurement Symbols

WL	Water Level	BCR	Before Casing Removal	DCI	Dry Cave-In
WS	While Sampling	ACR	After Casing Removal	WCI	Wet Cave-In
WD	While Drilling	▽	Est. Groundwater Level	⊽	Est. Seasonal High GWT

The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in a granular soil. In clay and plastic silts, the accurate determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally applied.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is larger than No. 200 Sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5 percent GW, GP, SW, SP; More than 12 percent GM, GC, SM, SC; 5 to 12 percent Borderline cases requiring dual symbols [b]	$C_u = D_{60}/D_{10}$ greater than 4; $C_c = (D_{30})^2/(D_{10}xD_{60})$ between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM [a]	d	Silty gravels, gravel-sand mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			GC		Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line or P.I. less than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = D_{60}/D_{10}$ greater than 6; $C_c = (D_{30})^2/(D_{10}xD_{60})$ between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM [a]	d	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or P.I. less than 4	Limits plotting in CL-ML zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
				u				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 Sieve)	Silts and clays (Liquid limit less than 50)		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL		Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
	Highly Organic soils		Pt		Peat and other highly organic soils			



[a] Division of GM and SM groups into subdivisions of d and u are for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when L.L. is 28 or less and the P.I. is 6 or less; the suffix u used when L.L. is greater than 28.

[b] Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC,well-graded gravel-sand mixture with clay binder. (From Table 2.16 - Winterkorn and Fang, 1975)

CLIENT	JOB #	BORING #	SHEET
Anderson & Associates, Inc.	01:25638	A-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Clarke County Little League Field Lighting	Anderson & Associates

SITE LOCATION

Route 340, Berryville, Clarke County, VA

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION 651

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0							
	S-1	SS	18	7			12 50
						650	
2.5	S-2	SS	4	4			50/4
						647.5	
	S-3	SS					
5							
						645	
7.5							
						642.5	
10							
						640	
12.5							
						637.5	
15							

Topsoil Depth [4.00"]

(CL) LEAN CLAY WITH GRAVEL (Limestone Fragments) , Reddish Brown, Moist, Medium Stiff

AUGER REFUSAL @ 4.4'

50/6

50/4

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL DRY WS ☐ WD ☒	BORING STARTED 03/25/16	CAVE IN DEPTH @ 3.0'
WL(BCR) DRY WL(ACR) DRY	BORING COMPLETED 03/25/16	HAMMER TYPE Manual
WL	RIG CME 550B FOREMAN RAS	DRILLING METHOD 2.25HSA

CLIENT	JOB #	BORING #	SHEET
Anderson & Associates, Inc.	01:25638	A-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Clarke County Little League Field Lighting	Anderson & Associates

SITE LOCATION: Route 340, Berryville, Clarke County, VA

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT²

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

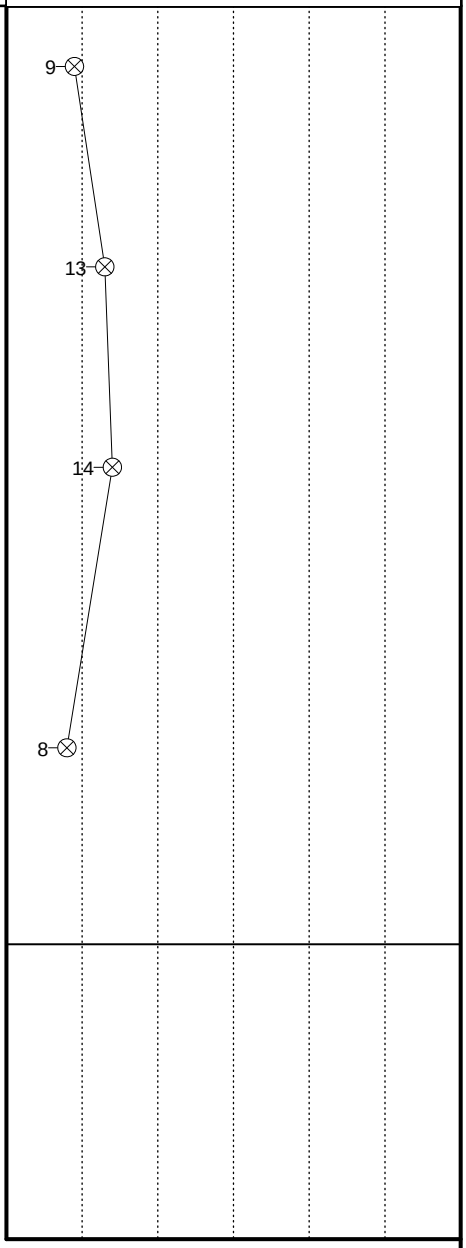
STANDARD PENETRATION BLOWS/FT

ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION 100%

SURFACE ELEVATION 651

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	18	14	Topsoil Depth [7.00"]			3 4 5
					(CL) LEAN CLAY, Reddish Brown, Moist, Medium Stiff to Stiff		650	
2.5	S-2	SS	18	18			647.5	4 6 7
5	S-3	SS	18	18	(CH) FAT CLAY, Reddish Brown, Moist, Medium Stiff to Stiff		645	4 6 8
7.5	S-4	SS	18	15			642.5	6 4 4
10	S-5				Rock Ledge @ 10.9'		640	
12.5					AUGER REFUSAL @ 11.7'		637.5	
15								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL DRY WS ☐ WD ☒	BORING STARTED 03/25/16	CAVE IN DEPTH @ 9.2'
WL(BCR) DRY WL(ACR) DRY	BORING COMPLETED 03/25/16	HAMMER TYPE Manual
WL	RIG CME 550B FOREMAN RAS	DRILLING METHOD 2.25HSA

CLIENT	JOB #	BORING #	SHEET
Anderson & Associates, Inc.	01:25638	B-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Clarke County Little League Field Lighting	Anderson & Associates

SITE LOCATION: Route 340, Berryville, Clarke County, VA

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

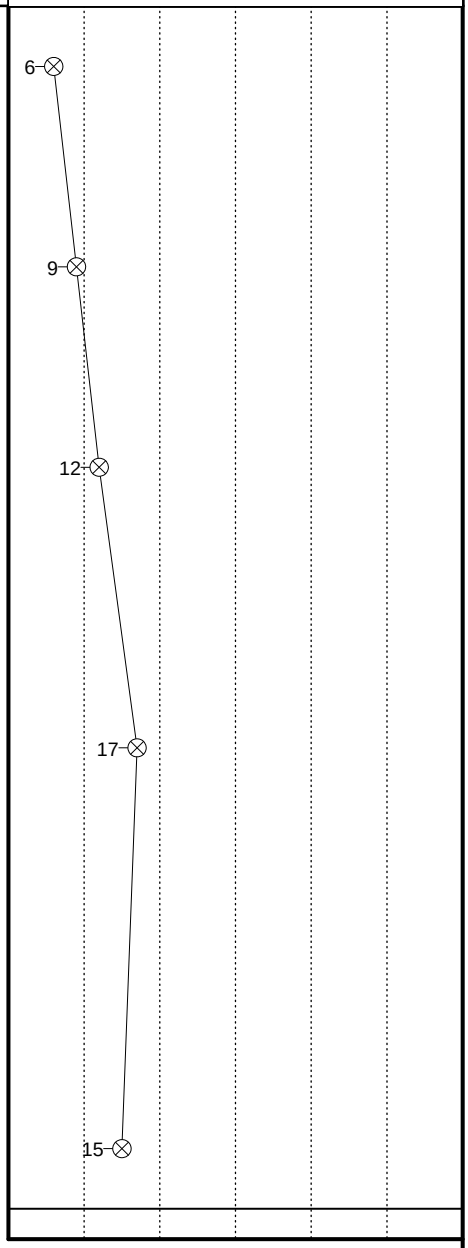
ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

BOTTOM OF CASING | LOSS OF CIRCULATION | SURFACE ELEVATION 650 | ENGLISH UNITS

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Depth [7.00"]		650	
	S-1	SS	18	16	(ML) Clayey SILT, Brown, Moist, Medium Stiff			2 3 3
2.5							647.5	
	S-2	SS	18	18	(CH) FAT CLAY, Reddish Brown, Moist, Stiff to Very Stiff			3 4 5
5							645	
	S-3	SS	18	18				3 5 7
7.5							642.5	
	S-4	SS	18	18				3 7 10
10							640	
12.5							637.5	
	S-5	SS	18	18				4 6 9
15					END OF BORING @ 15.0'		635	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL DRY WS ☐ WD ☒	BORING STARTED 03/25/16	CAVE IN DEPTH @ 12.3'
WL(BCR) DRY WL(ACR) DRY	BORING COMPLETED 03/25/16	HAMMER TYPE Manual
WL	RIG CME 550B FOREMAN RAS	DRILLING METHOD 2.25HSA

CLIENT	JOB #	BORING #	SHEET
Anderson & Associates, Inc.	01:25638	B-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Clarke County Little League Field Lighting	Anderson & Associates

SITE LOCATION

Route 340, Berryville, Clarke County, VA

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ▶ — LOSS OF CIRCULATION (100%)

SURFACE ELEVATION 650

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0						650	
	S-1	SS	18	17			2 2 3
2.5						647.5	
	S-2	SS	18	18			4 7 8
5						645	
	S-3	SS	18	18			5 6 8
7.5						642.5	
	S-4	SS	18	18			3 5 6
10						640	
12.5	S-5					637.5	
15						635	

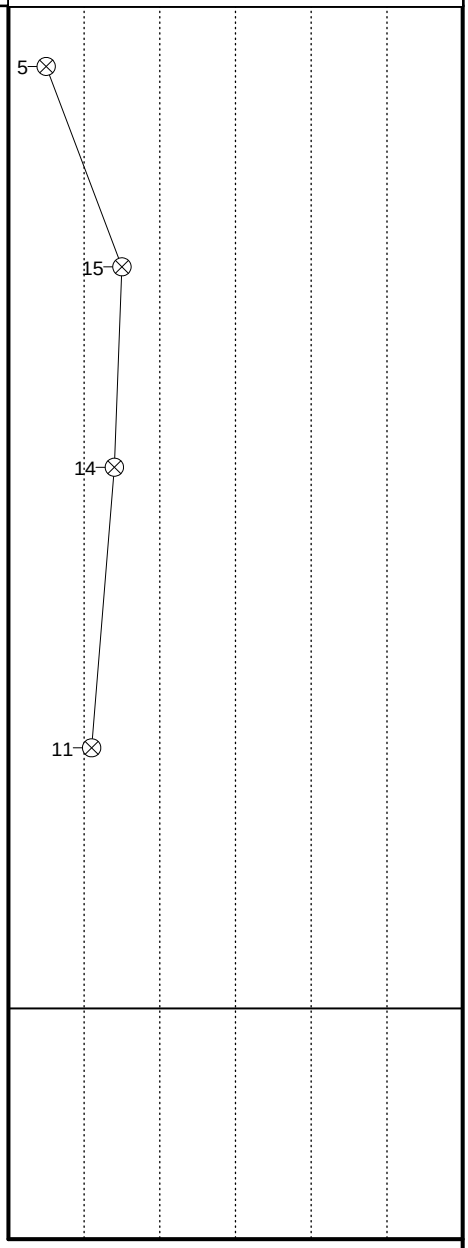
Topsoil Depth [14.00"]

(ML) Clayey SILT, Brown, Moist, Medium Stiff to Stiff

(CH) FAT CLAY, Reddish Tan to Reddish Brown, Moist, Stiff

Rock Ledge @ 11.2'

AUGER REFUSAL @ 12.5'



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL DRY WS ☐ WD ☒	BORING STARTED 03/25/16	CAVE IN DEPTH @ 10.4'
WL(BCR) DRY WL(ACR) DRY	BORING COMPLETED 03/25/16	HAMMER TYPE Manual
WL	RIG CME 550B FOREMAN RAS	DRILLING METHOD 2.25HSA